DOCUMENT RESUME

ED 308 329 CE 052 708

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TITLE A Study of Arizona Labor Market Demand Data for Vocational Education Planning.
INSTITUTION Northern Arizona Univ., Flagstaff. Center for Vocational Education.
SPONS AGENCY Arizona Occupational Research Coordinating Unit, Phoenix.
PUB DATE Mar 84
NOTE 38p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Decision Making; *Educational Planning; *Employment Projections; *Labor Needs; Literature Reviews; *Methods Research; Statewide Planning; *Vocational Education
IDENTIFIERS *Arizona

ABSTRACT

A study examined the project methodology used by the Bureau of Labor Statistics and the related projections made by the state employment security agencies. Findings from a literature review indicated that the system has steadily improved since 1979. Projections made from the Occupational Employment Statistics Surveys were remarkably accurate. Suggestions from the literature for the improvement of the projection methodology were: (1) follow-up studies for collecting information to use in developing allocation ratios; (2) improvement of projection information on replacement needs; (3) improvement of substate projections; (4) inclusion of all employment sectors in projections; (5) collection of information on entry-level occupations; (6) inclusion of a statistical indication of the accuracy of projections; (7) consideration of earnings when planning programs; and (8) improvement of communications between producers and users of employment projection information. Semistructured interviews were conducted with individuals within Arizona who had an intimate knowledge of employment projection methodology information. They indicated that confidentiality restrictions limited the availability of certain information at the county level and the lack of information on replacement needs due to occupational mobility limited demand data. The major problem was users who did not understand how to use the labor market information for decision making. (55 references.) (YLB)

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A STUDY OF ARIZONA LABOR MARKET DEMAND DATA FOR VOCATIONAL EDUCATION PLANNING

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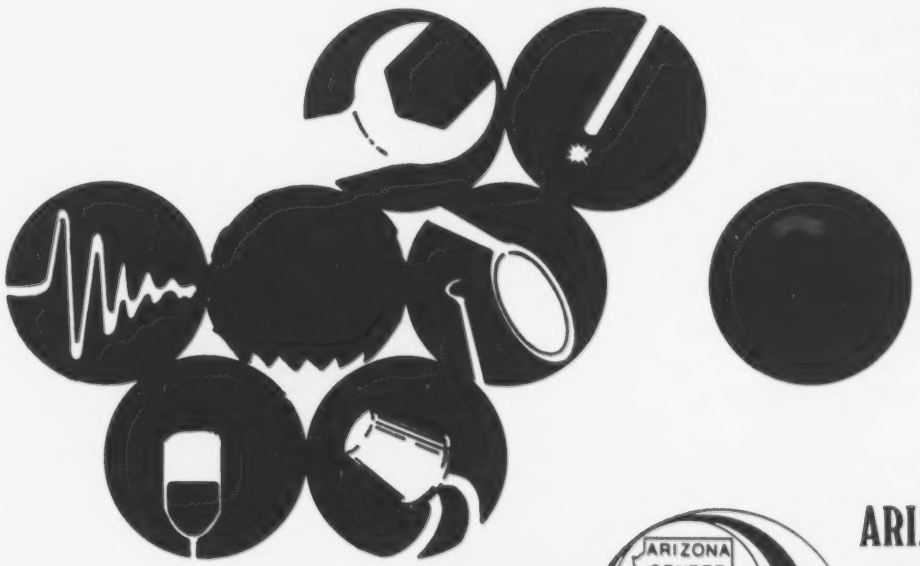

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A STUDY OF ARIZONA LABOR MARKET DEMAND DATA FOR VOCATIONAL EDUCATION PLANNING

by

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March, 1984

FUNDING INFORMATION

Project Title:	Project 1995
Educational Act Under Which the Funds Were Administered:	Education Amendments of 1976, P.L. 94-482
Source of Contract:	Arizona Department of Education Phoenix, Arizona
Contractor:	Arizona Center for Vocational Education Northern Arizona University Flagstaff, Arizona 86011
Disclaimer:	This publication was prepared pursuant to a contract with the Research Coordinating Unit, Arizona Department of Education. Contractors undertaking such projects under government sponsorship are encouraged to express freely their judgment professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official Arizona Department of Education position or policy.
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FORWARD

Project 1995

Project 1995 was funded in March, 1983, to provide direction for Vocational Education in Arizona through the year 1995. The study had seven objectives which resulted in the following seven monographs:

- Analysis of Arizona Labor Market Demand Data for Vocational Education Planning
- Analysis of Vocational Education Follow-up Procedures
- Analysis of Data on the Nature and Scope of Vocational Education Programs in Arizona
- Articulation of Vocational Education Programs in Arizona
- Analysis of State Funding Alternatives for Vocational Education
- A Model for Determining Vocational Education Funding Priorities
- A Plan to Improve Arizona Vocational Education Data Systems

Although each monograph covers a specific area of study, there are relationships among them and all provide recommendations for improvements in Arizona's vocational education data systems.

A number of recommendations for short-term and long-range modifications in the data systems have been made. As these changes are implemented, more valid and reliable data will be available to plan vocational education in the future.

Acknowledgements

We wish to thank the members of Task Force 1995 for their support and guidance throughout the duration of the project. We acknowledge the efforts of the Technical Review Committee members for their time in providing direction and in reviewing the monograph. The memberships of the Project 1995 Task Force and the Technical Review Committee are presented in Appendix A.

Special acknowledgement is given to members of the Vocational Education staff, Arizona Department of Education and of the Labor Market Information staff, and the Arizona Department of Economic Security for their time and contribution to the project. The project staff is indebted to those who gave of their time and expertise through the interviews. A list of persons interviewed is in Appendix B.

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EXECUTIVE SUMMARY

This monograph describes a study of projection methodology used by the Bureau of Labor Statistics for projecting work force needs. Second, users' feelings about the system are investigated and reported. The system has steadily improved since 1979, when the base for making employment projections was moved from decennial census data to Occupational Employment Statistics (OES) Surveys. Projections which have been made from the surveys have been remarkably accurate. However, constraints still remain in the use of the information by vocational educators. For example, confidentiality restrictions limit the availability of certain information at the county level and the lack of information on replacement needs due to occupational mobility limits demand data. The major problem identified was with users who reported that they did not understand how to use the labor market information for decision making.

Recommendations center around two major themes: minor improvements in the demand data and the need for vocational education personnel to learn about labor market demand data and how to use it. Labor market demand data may be improved by examining "turn over" and the movement of personnel within a business or industry through promotion. Greater use of labor market demand data in vocational education decision making may be accomplished by training vocational education personnel in the use of Labor Market information for vocational education decision making. This monograph may serve as a first step describing the current system for arriving at labor market demand data.

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Chapter 1

INTRODUCTION

For many years Federal congressional mandates have stressed the importance of strong linkage between the preparation youths were provided in vocational education programs and actual job opportunities in the labor market. The 1968 Amendments to the Vocational Education Act of 1963 (P.L. 90-576) set forth, in part, the purpose of the grants to states was to assist them in providing vocational training "which is realistic in the light of actual or anticipated opportunities for gainful employment" (Section 101). This was a beginning. Despite setting aside sizeable amounts of money with which to fund projections of manpower needs, little was accomplished to improve projection information and the utilization of this information in Vocational Education program planning.

Drews and Katz (1975) examined the failure to use manpower information and found a distrust of, disinterest in, and a lack of understanding of manpower data and projections by education officials. This study further noted: (1) there was a preference for depending on local advisory committees for information on employment opportunities; (2) after a vocational program was installed, manpower projections played a minor role in future programmatic decisions; and (3) there were failures of coordination and cooperation between educational and manpower agencies.

The state of affairs was reflected in the 1975 report by the National Advisory Council on Vocational Education (p. 3) which stated:

> The report notices that too many students have been trained in fields where there are too few or no jobs, and that the school systems are too slow in updating course content or adding new courses in fields where jobs exist.

As a result of these concerns, the Educational Amendments of 1976 (P.L. 94-482) mandated that state five-year and annual plans must "...assess the current and future needs for job skills within the state...through consideration of the latest available data on present and projected employment..."

The National Occupational Information Coordinating Committee (NOICC) and cooperating State Occupational Information Coordinating Committees (SOICC) were authorized. Their authorized objectives were: (1) to improve coordination between producers and users of occupational information, and (2) to develop an occupational information system including data on occupational supply and demand, based on uniform definitions, classifications, and estimating procedures. The purpose, as stated by the House Committee on Education and Labor, was "to develop

both occupational supply and demand data and to make this data readily available so that vocational courses which are more relevant to realistic job opportunities can be offered" (National Occupational Information Coordinating Committee, 1979, p. 2).

The State Occupational Information Coordinating Committees became operational in Fiscal Year 1979 (National Occupational Information Coordinating Committee, 1980). This has the potential for a large impact on Vocational Education program planning in that the information available to state planners is qualitatively superior to that which was available previously.

Chapter 2

PURPOSE OF THE STUDY

The purposes of this study were: (1) to examine the projection methodology used by the Bureau of Labor Statistics and the related projections made by the state employment security agencies, (2) to assess strengths and weaknesses in the information, and (3) to recommend a system for projecting Arizona Vocational Education needs. This study was a part of a comprehensive study to provide direction for vocational education in Arizona. Manpower data is a basic source of information for making decisions in vocational education, but it should not be the sole source used.

Chapter 3

REVIEW OF LITERATURE

Until the mid 1970's the best information on manpower requirements was provided by skill surveys conducted by employment security agencies. In those skill surveys, employers were asked to indicate their present number of employees by occupation and to indicate their needs two to five years into the future. These skill surveys had a rather dubious record of success in making accurate projections (Goldstein, 1980). Very often, when projections from skill surveys were compared to actual employment in the same firms for the target year, substantial errors were found for many occupations. The skill surveys were also costly. In 1975 the Employment and Training Administration of the Department of Labor announced to the state agencies that it was abandoning skill surveys in favor of an analytical approach (BLS, 1980).

The Bureau of Labor Statistics (BLS) economic growth projection methods are reviewed in the following section. These methods are used in the preparation of the Occupational Outlook Handbook as well as to project employment demand by industry and occupation ten years or more into the future. These methods are the foundation upon which projections for educational planning and training are made at the national, state, and local levels. The BLS conducts an ongoing research program that investigates the accuracy of previous projections and analyzes methods to improve future projections. The salient aspects of the projection methodology are discussed under the following headings: assumptions, national projections, state and local projections, limitations (crosswalks and expansion and replacement), statistical issues, and entry level vs. all jobs reporting.

Assumptions

All analytical methods of projection begin with certain assumptions about the future. A general assumption basic to all economic growth projections is that past economic patterns will continue into the future and change in these patterns will occur slowly. Blake (1981) has referred to this as a "surprise-free" methodology meaning that future surprises such as major depressions, wars, and emerging technologies are assumed to be inoperative.

Other assumptions needed in making long-term projections have to do with the business cycle. Cycles, as such, are difficult to anticipate. A smooth trend is typically projected even though it is expected that the actual course of events will be irregular (Goldstein, 1980). For example, an average of relatively low levels of unemployment is typically assumed.

Some of the specific assumptions made in the BLS projections to 1990 are as follows:

1) Inflation will decelerate to 5.2 percent annually during 1980-1990.

2) A stable, long-run unemployment rate close to 4.5 percent will be achieved by the mid 1980's.

3) Higher energy prices will not constrain growth in GNP.

4) The institutional framework of the U.S. economy will not change radically.

5) Current social, technological, and scientific trends will continue.

6) No major event, such as widespread or long-lasting energy shortages or war, will significantly alter the industrial structure of the economy or alter the rate of economic growth.

A number of other assumptions are considered. These include: (1) information regarding Federal personal income taxes, (2) recovery in the rate of increase of productivity, (3) population projections of the Bureau of the Census, (4) Social Security contribution rate, (5) exports, (6) corporate profit tax rates, and about 25 other pieces of information (BLS, 1980).

The understanding of these assumptions is important to users of this information. The validity of the projections can be judged by the realities of the economy. Planners may adjust their own projections based on the "fit" between these assumptions and the actual state of the economy.

National Projections of Employment Demand by Industry

The first step in the BLS projection methodology involves national projections of employment demand by industry. This is summarized below. For a more detailed discussion the reader is referred to the BLS publication methodology for projections of industry employment to 1990 (BLS, Bulletin 2112, 1982).

The rationale of the projections is to estimate the structure and composition of the economy of the United States ten years into the future. The methodology utilizes a complex 50 equation macroeconomic model. The BLS begins with the growth of the population as estimated by the Bureau of the Census. Based on this, projections are made of the growth of the labor force and GNP is then estimated, given a 4.5 percent unemployment assumption. Next, the demand for each kind of goods or

services generated by the income associated with the GNP is estimated, and from this industry production and employment levels are estimated. The production levels in each industry for the projection years are translated into manpower requirements on the basis of projections of output per man-hour (i.e. productivity) and average hours of work.

The accuracy of these projections has been a common concern of many of those individuals who have utilized these data. Personick and Sylvester (1976) examined the accuracy of projections for 1970, which were based on data through 1964. They found that employment increased by 17 percent instead of the projected 15 percent increase. The direction of employment change was correctly projected for 63 of the 74 industries. Out of 9 industries in which declines occurred, declines were predicted in 7; on the other hand, the projections predicted declines in nine industries that actually had increases.

The next step in generating demand projections is to translate industry employment levels into occupational employment. This is accomplished by estimating the occupational composition of each industry for the projected year and then calculating the total for each occupation in all industries.

Data on the occupational composition of industries has, until recently, been available only through the decennial census of the population. This is a household survey in which members of each household report the occupation and the industry in which they work. Trends in the composition of each industry are analyzed and related to known changes in industrial technology to estimate composition in the year to be projected. This methodology has received much criticism in the past for being unscientific and based mainly on judgmental criteria (Goldstein, 1980).

The BLS has published an evaluation of its occupational employment projections (Carey, 1980), comparing actual 1975 employment data with projections it made for 1975 in 1967. BLS found that projections of the major occupational groups were more accurate than those for individual occupations. Projections for large occupations had less error than those for small ones. In 64 of 76 occupations for which a comparison was possible, the direction of change was projected correctly. Out of 21 occupations in which there were actual declines, the projections correctly predicted declines in only five. The percent changes projected for the individual occupations for the period from 1960 to 1975 were fairly close to the changes that actually occurred (correlation coefficient of .78).

State and Local Projections

Prior to 1979 the industry occupation matrix developed from the decennial census was the basic analytical tool used in making state employment projections. The general approach was to develop current estimates of occupational staffing patterns of industries, project these

patterns to the target year of the projections (e.g. 1990), and multiply the projected patterns by projected industry employment levels. The products, projected occupational employment by industry, were then summed across industries to derive an estimate of projected total employment by occupation (BLS, 1982).

The primary data base for occupational employment has changed from the decennial census to the Occupational Employment Statistics (OES) surveys. This OES program is a Federal Department of Labor/State Department of Economic Security cooperative program. The OES program produces statewide and county data on projected and current employment by occupation and industry. This is accomplished by a direct survey of employers. From a sample of employers in each industry, the OES surveys are conducted by personal visits to employers and, also, by mail and telephone. They are conducted on a three-year cycle in which manufacturing industries are surveyed in the first year and non-manufacturing industries and trades establishments are surveyed in the second and third years. The survey collects employment information of non-farm establishments (BLS, 1982).

The Industry-Occupation Matrix is then constructed from this information. The matrix shows occupational employment by industry for the state as a whole and for individual counties. This matrix provides estimates of current employment and is used to project future occupational employment and average annual openings by occupation.

Econometric models of Arizona's metropolitan and nonmetropolitan areas have been developed to forecast industrial employment (the genesis of occupational employment forecasts). The models are composed of over 200 equations and forecast detailed employment by industry for more than ten years into the future. Because the state's growth depends upon both local variables (i.e. overall employment growth, local unemployment rates, etc.), as well as important national economic variables (i.e. Gross National Product, housing starts, personal income, etc.), these models incorporate both local and national influences in the forecasting process.

The OES survey is the most accurate system that has been devised to date to estimate current employment and project future employment by occupation. The OES survey has a number of advantages over the previous methodology that relied on the decennial census survey of households. First, the census survey provided updated information every ten years. The OES survey is conducted over a 3-year cycle: manufacturing industries one year; non-manufacturing, except trade and TCPU (transportation, communication and public utilities) the second year; and the balance the third year. Second, the OES survey is more accurate. This is due to the fact that the OES survey is filled out by employers who are given detailed definitions of occupations. The previous census survey was filled out by employees, thus introducing bias due to the tendency of employees to "upgrade" their actual occupational status when reporting. A third advantage concerns the greater detail that is offered through the OES survey. The BLS (1982) reports that the size of the Industry-Occupation Matrix in the 1978-1979 projections increased to 1,678 detailed occupations in 378 industries,

as opposed to 377 occupations and 201 industries in the 1970 census based matrix. Another useful feature of the OES survey is that it is capable of being analyzed by the factors that may affect occupational composition, such as the size of the firm and the particular production process used, thus making it possible to project occupational composition more accurately. The 1983 survey of manufacturing introduced a revised coding structure which consists of approximately 700 occupational classifications. Compatible with the 1980 Standard Occupational Classification (SOC) system, the structure is organized more concisely and reflects a workplace that is becoming more technology oriented. This new coding structure will render existing OES crosswalks obsolete. In the future, significant effort will be dedicated to updating the crosswalk.

For a more detailed discussion of the OES survey, the reader is referred to the Occupational Information System of Arizona Users' Manual, 1981.

Limitations of Projection Methodology

A major problem associated with projection methodology includes communicating in meaningful ways about the results of the different systems. No set of data categories and definitions are subscribed to by all parties to the information exchange activity. In response to this problem correspondence indices, called crosswalks, relating the various classification systems to each other and to the United States Office of Education (USOE or OE) program codes have been developed.

A second problem is the identification of the kinds and number of new jobs in the labor market and the job openings created by persons leaving the labor force. These factors, referred to as expansion and replacement, as well as crosswalks are discussed in the following sections.

Crosswalk

A key component in the employment projection methodology is the "crosswalk." The classification systems that are commonly utilized include the following: Dictionary of Occupational Titles (DOT) codes, Occupational Employment Statistics (OES) codes, and Standard Occupational Classification (SOC) codes.

Crosswalks are needed since there is no standardized occupational pivoting structure. Different groups collect occupational information for different purposes. The result is that the data collected is not directly comparable (Morgan, 1976). The problem has been that vocational educators want to know their training needs in OE program categories, but all of the projection information is generated using other classification systems which must be converted to OE categories. The state of the art in the recent past was summarized by Roskam (1976).

He concluded that there was no occupational classification system in existence that offered enough information to convert well into OE instructional program codes.

Because of the incompatibility of classification systems, users of this information must develop assignment codes that allow the comparison of information between different coding systems. An example of the large discrepancy that exists between coding systems can be seen in the fact there are approximately 12,000 DOT codes while there are 250 OE codes. The degree to which projections capture actual employment appropriate to the educational programs is determined by the skill brought to bear on the generation of assignment codes. Halverson, Murphy, and Thoemke (1978, p. 18) assessed this issue as follows: "It should be kept in mind that no matter how sophisticated the internal algorithms of the system are, if the assignment codes are not appropriate, then the projection will be unsatisfactory. Therefore a great deal of care must be taken in the development of the crosswalks."

The state of the art has been improved in the recent past. For example, the Occupational Information System of Arizona Users' Manual utilizes the crosswalk developed by the National Occupational Information Committee (NOICC) and others. This crosswalk was published in Vocational Preparation and Occupations, Volume 1: Occupational and Educational Code Crosswalk (1979).

The following quotation from OIS Users' Manual (p. 12-5) is an excellent illustration of the present procedure:

> An important concept of the OIS of Arizona is the ability to convert data from one classification to another. This cannot simply be accomplished by use of a crosswalk because codes in two different classification systems are not necessarily related on a one-to-one basis. A given OES code might be related to five DOT codes. This means that employment of say 100 persons in the OES code would have to be allocated in some way to the five DOT codes if conversion from OES to DOT codes was desired. This is the function of the allocation factors which were developed utilizing Arizona State Occupational Coordinating Committee (ASOICC) staff and Arizona Labor Market Information (LMI) staff.
>
> There are around 12,000 DOT codes, 250 OE codes, 1,800 OES codes and 800 SOC codes. For OIS of Arizona purposes, it was determined that allocation factors be developed for conversion from OES to DOT, DOT to OE, OES to OE, DOT to SOC and OE to DOT. Utilizing these factors and the VPO crosswalk, the OIS can prepare outputs in OE, DOT or SOC code formats.

The development of allocation factors depended heavily on two sources of information. The first was the Employment Service Automated Reporting System (ESARS), Table 96, Total Job Orders Received for 1978, and the second was the Unemployment Insurance (UI) Claimant Master File for calendar year 1978, which listed the number of claimants for each nine-digit DOT code.

The following quotation from the OIS Users' Manual (p. 12-6) is an excellent illustration of the methodology.

> To compute the OES to OE code allocation factors a printout was prepared by OE codes within OES codes. Then, for each OE code, the demand levels for related DOT codes were calculated. This was accomplished for a given nine-digit DOT code by noting the number of job orders for the corresponding three-digit group and then calculating the relative importance of the nine-digit code based on its relative frequency in the UI claimants file. This relative frequency was then multiplied times the three-digit job orders. This procedure was followed for each DOT code under a given OE code and this demand by DOT code was totalled for each OE code. Then, based on this relative frequency of each OE code within an OES code the allocation factors were computed. Adjustments were made in the limited number of cases where a DOT code was contained in more than one OE or OES code.

The preceding discussion was intended to illuminate the nature of the methodology as it currently exists. The present procedures are a distinct improvement over methodology of the recent past. However, there are certain limitations in the current methodology. For example, the information used to determine the allocation factors was gathered in 1978. This information is accurate to the extent that employment opportunities and occupational composition remain unchanged. Bias is introduced if this is not the case. A second limitation is that the Employment Service Total Job Orders information may not offer a comprehensive picture of the job market. Union jobs and higher level professional jobs are usually not filled through the Employment Service. Therefore, this information may give a biased view of occupational demand to the extent that it does not accurately reflect total job openings (OIS Users' Manual). A third limitation centers on the possibility that the allocation factors may overestimate the demand for training in certain vocational education program areas. This may be the case because some occupations may not be filled, or may be only partially filled, by vocational education program graduates. If this is the case, the OE program demand projection may be an overestimate of true occupational opportunities.

For further information, the reader is referred to the excellent discussion of the crosswalk methodology in the Occupational Information System of Arizona Users' Manual.

Expansion and Replacement

The methodology used in making employment projections separates the demand for occupational employment into expansion and replacement. Expansion opportunities represent new jobs created by economic growth. Expansion is computed as the numerical difference between employment in the base and the projection years. Replacement opportunities represent

job openings created by persons leaving the labor force for reasons such as retirement, death, pregnancy, or severe injury.

Information on replacement rates is developed by the BLS from data obtained from working life tables. The working life table is an actuarial device that summarizes labor force activity and mortality in the population. It applies death and labor force participation rates to a hypothetical popubihtre prn aios zain rp ixaM Data from the decennial census is used to develop tables for each individual state. These tables are not developed for individual occupations. Estimates of occupational openings due to separations are obtained by applying separation data developed for a future year to an Industry-Occupation Matrix developed for that same year (OIS Users' Manual).

This discussion points to a significant weakness in the replacement needs information that is currently available. The estimates of labor force separations were based on working life tables that pertained to the entire population and did not reflect actual differences in patterns among occupations (BLS, Bulletin 2112, 1982). Error is introduced because there is a great deal of variability among occupations in the rate of separation from the labor force.

A second concern regarding projections of replacement needs is the omission of information regarding job turnover due to occupational mobility (Halverson et al, 1978; Stevens, 1976). This is unfortunate since job turnover is the major source of job openings for some occupations. Discussing this issue at a national conference concerning projection information and its use in vocational education, Shackett (1976, p. 98) was asked if a system exists that incorporates job turnover information. He replied: "There is a national system that reports this by industry. It applies the turnover rates for a given industry to all of the occupations in that industry--it's just worthless." Unfortunately, it seems that the state of the art has changed little since 1976.

A third concern with replacement projections is the omission of information regarding estimates of the number of persons who left the labor force temporarily. In a recent study investigating these issues, Sommers and Eck (1977) found that between the years 1965 and 1970, changing occupations was twice as common as leaving the labor force. It should be kept in mind, however, that workers shift both into and out of a given occupation. Therefore, even though the total changes of occupations may be significant, the net change within any given occupation may be small.

Statistical Issues

There are a number of statistical issues that must be kept in mind when using employment projection information. The first concern has been discussed in a previous section of this paper but deserves mention here again. Projections are based on numerous assumptions about the

economy. To the extent that these assumptions are at variance with the actual state of affairs, error will be introduced into the projections (Halverson et al, 1978). However, faulty assumptions that are known can be changed, while a model based on unstated assumptions offers no guidance to the user.

A second issue is that projections are the result of sophisticated mathematical equations that "model" the economy. By definition this is an approximation of the real economic system. It cannot account for all the variables that may influence the economy. Therefore, some degree of error is implicit in the methodology (Halverson et al, 1978).

A third concern is that the industry-occupation information obtained by the OES survey of employers is based on a sample of the total population of employers and can be expected to contain small random errors. The following discussion of Arizona's OES survey illustrates the current procedure. The source of information on the population of employers is the Unemployment Insurance Section of the Department of Economic Security. This gives information on the number of employees as well as related wage data. According to the Occupational Information System of Arizona Users' Manual (pp. 13-2, 13-3):

> In general, all firms with 50 or more employees will be included in the sample. If a firm has 100 or more employees that firm will most likely be visited personally by an OES interviewer. For firms employing less than 50, the questionnaires are mailed and followed up with telephone calls. In part, the sample size in a given sector depends on the number of firms in that sector. The larger the number of firms, the smaller the percentage sampled. For example, for the Drug Store industry in Pima County, for those employing from four to nine people, one employer out of three is sampled; for those employing 10 to 19 people, one of every two is surveyed; and for those employing 20 or more, all employers are surveyed.

A related issue is that certain occupational information may not be reported when this information would tend to reveal the operations of an individual firm or organization (Stevens, 1976). This OES survey data may not be reported if any of the following conditions exist:

1. Less than three firms report an occupation in an industry.

2. A single firm reports 50 percent or more of the specific occupation in an industry.

3. Two firms combined represent more than 75 percent of the occupation reported (OIS Users' Manual).

The following is descriptive of the present procedure used in Arizona OIS Users' Manual (pp. 13-4, 13-5):

Regarding the 1981 OES Survey, the operational approach taken to assure preservation of confidentiality is described next. For a nonmetropolitan county, no employment level was reported for an occupation employing under ten persons. Additionally, for counties, no data on employment levels in certain occupations employing ten or more was provided if it was determined to violate the confidentiality requirement. For Arizona as a whole, the impact of confidentiality on the 1981 release was that estimated employment levels for 1981, 1982, and 1986 were not reported for 504 occupations or 44 percent of the total reported 1,131 occupations. Clearly, however, the occupations reported account for the greatest part of employment. The confidentiality restrictions do not apply to estimates of job opportunities based on job openings and separations, and these are most important for planning purposes. Job opportunity data in the 1981 OES matrix projections were projected for all occupations at the statewide and county level by OES code for 1981-1982, 1981-1986, and 1985-1986; and for the 1981-1986 period, job opportunities were broken into the two components of growth and separation. Future OES reports are expected to provide these same data categories.

From this information it is apparent that confidentiality standards restrict the provision of certain data, while projection of job opportunities due to growth and replacement are relatively unaffected by these restrictions.

A final area of concern involves certain industry sectors of the work force that were not included in the industry matrix projection. Omitted from existing employment statistics were five categories of workers: agriculture production, self-employed workers, private household workers, unpaid family workers, and full-time homemakers (NOICC, 1980). NOICC (1980) reported that the Oklahoma SOICC had been funded for a special project to estimate occupational employment and demand in the sectors of agriculture, private household workers, unpaid family workers, and self-employed workers. According to Hunter (no date) in Oklahoma a sizeable portion (14%) of statewide job openings occurred in the agricultural, self-employed, unpaid family workers and private household workers categories. In this study a form of regression analysis was used as the basic tool in the projection of industry employment in these four areas. Steps in developing the projections, together with the formulas used, are available in the report.

Agricultural Employment Studies in Arizona

Because of the variety of jobs employing agricultural competencies in a widely diverse industry, data on agricultural employment have been difficult for traditional reporting agencies to secure. Since 1970 reports have been published by the College of Agriculture at the

University of Arizona on agricultural occupations for the Sate and certain counties (Zurbrick, 1982). The 1982 study was expanded to include a wider geographic area than in previous studies. Still excluded were northern parts of the state so that ranching and forestry industries were under-represented in the employment survey.

The studies included high school and community college districts within Arizona. These districts comprised a majority of the State's population and the State's irrigated lands (Zurbrick, 1973). Five hundred eighty-six randomly sampled businesses participated in the study. All job titles reported were categorized into one of five instructional program areas.

Full-Time Homemakers

Another group for whom it is difficult to make projections is the group of full-time homemakers. Under present day circumstances this group is composed of both women and men, the latter in considerably smaller numbers than the former. While no particular organization reports the data on the group of full-time homemakers, it is possible to use Arizona census data to make some rough estimates. Every year in March Arizona participates in the Current Population Survey. In the March, 1983, report, findings were based on a sample of 2,229 individuals. Using statistical projection techniques, 357,357 full-time homemakers were identified.

Entry Level vs. All Jobs

Another problem which limits the usefulness of projections for educational program planning purposes is that the projections of employment demand represent total job opportunities. Demand data include entry-level positions as well as positions requiring more extensive work experience (Halverson, Murphy, and Thoemke, 1978; Stevens, 1976). Secondary and some post-secondary vocational program graduates typically get into a firm at an entry level and then may be promoted to higher levels based on job performance. However, the current projection methodologies include estimates of replacement needs for occupations to which workers are promoted. The average graduate of a vocational program does not have access to these jobs. Brown (1976, p. 113) noted the following:

> The whole idea of making projections for use in determining training programs is very puzzling...One of the things that is puzzling is that vocational educators feel that they train people for entry-type jobs. And this particular projection methodology doesn't get to entry type jobs. It focuses on an "all jobs" concept.

Recommendations From The Literature

The following section will review some of the more salient suggestions from the literature for the improvement of the projection methodology:

1. Follow-up Information for Use in Developing Allocation Ratios.

To link the crosswalk methodology and projections more closely to the actual experience of Vocational Education program graduates, the NOICC 1980 report and others have suggested that follow-up studies on former students are needed to provide information on the occupational experience of these individuals. These data could be used to develop occupational allocation ratios based on past experience, to estimate the number of students who are likely to enter the labor force and the number who will enter each related occupation.

2. Improve Projection Information on Replacement Needs

BLS Bulletin 2112 (1982) indicated that there is a significant ongoing research effort to correct the previously mentioned limitations. This is very important because replacement needs are a far more significant source of job openings than economic growth in almost all occupations. This BLS bulletin reports that data are being developed from the Current Population Survey (CPS) on the need to replace individuals who transfer to another occupation, retire, die, or leave the labor force for some other reason. The BLS publication Measuring Labor Force Movement: A New Approach (Report 581) (U.S. Department of Labor, 1978) explained the need for improved data about replacement needs and described preliminary efforts to develop this information.

The longitudinal nature of the CPS results in data being collected for the same individual in surveys 12 months apart. By tabulating occupational and labor force status data, annual data on movements into and out of occupations are obtained. This information is referred to as CPS matched data because individuals are identified by matching household, age, race, and sex information. CPS data overstate occupational changes. To overcome this weakness, CPS retrospective data from supplemental questions on occupational mobility were combined with CPS matched data to estimate occupational transfer. The longitudinal data which resulted from combining CPS matched and CPS retrospective data were termed merged CPS matched and retrospective data.

CPS matched and retrospective data were developed for 1977-1978 utilizing the 1974-1975 data that were published in BLS Report 581. The more recent data provide information about replacement needs and permitted comparisons of matched and retrospective data for January, 1977, to January, 1978. These comparisons indicated the reliability of merged CPS matched and retrospective data about movements into, out of, and between occupations. As a result, the merged and retrospective data were used in the preparation of the Occupational Outlook Handbook and Occupational Projections and Training Data to estimate replacement

needs, to document descriptions of occupational movements already being presented, and to add information not currently available. For example, the data will document information about the large number of jobs for food counter workers resulting from the need to replace young people who temporarily leave the labor force. By using merged CPS matched and retrospective data about occupational movements and by describing how jobs are created and filled, it is anticipated that information about employment opportunities will improve significantly (BLS Bulletin 2112, 1982).

3. Improvement of Sub-State Projections

The National Occupational Information Coordinating Committee (NOICC) (1980) report indicated that research was being conducted by the State Occupational Information Coordinating Committees in Colorado and Texas to improve sub-state projections. Part of the methodology included testing alternative methods of estimating occupational employment for sub-state areas using simulations from the OES data files. Results of these efforts may facilitate the projection methodology for the State of Arizona.

4. Include All Employment Sectors in Projections

The NOICC (1980) report also indicated efforts to account for employment in sectors that have not been reported in the past. These include agriculture production, agriculture services, self-employed workers, private household workers, and unpaid family workers. The report indicated that the Oklahoma SOICC was funded for a special project to estimate occupational employment and projected demand for agriculture, domestic, self-employed, and unpaid family workers. In addition the NOICC was involved in an interagency effort with BLS, Employment Training Agency, selected State Employment Security Agencies, SOICCs, and the U.S. Department of Agriculture to identify and test potential methods of surveying occupational employment in agriculture.

5. Collect Information on Entry-Level Occupations

Brown (1976) discussed a method employed in Utah to investigate entry-level positions. The Utah Employment Security Department was investigating claimers of unemployment insurance by asking employers to list all of the people they hire. This information was then matched with a list of those individuals receiving unemployment insurance. This was done on a quarterly basis. Brown (1976) asked the Employment Security Department if they would also get information on the occupational title of these new hires. Therefore, a hiring profile by industry could be obtained. This could then be matched up with the OES employment profiles to determine if there were any differences in the hiring patterns of the employers related to their total employment profiles. This information could also be used to identify entry level occupations, to investigate occupational accession rates (i.e., find out what proportion of the total employment in an occupation seems to be

turning over), and to investigate what penetration rate the Employment Service has of total jobs. The projection methodology could be improved by supplementing the OES data with estimates of the occupational distribution of these new hires.

6. Include a Statistical Indication of the Accuracy of Projections

Halverson, Murphy, and Thoemke (1978) have suggested that projection information include some statistical indication of the degree of accuracy of the projection. While it is recognized that it is difficult to assess the accuracy of projections, it was suggested that in theory, if the input uncertainties are known, it might be possible to quantify the output uncertainties. If this were the case, it might be possible to say that the projections of job opportunities in a given educational field in a given year are known to be within a certain range surrounding a most probable value. This range might be expressed as an upper and lower bound on the projection value, for example $\pm$ 20 percent.

Parenthetically, it should be noted that while information regarding the accuracy of long-term (6-10 year) projections is difficult to obtain, it is possible to assess the accuracy of short-term (1-2 year) projections. The Arizona Department of Economic Security publication, Arizona Labor Market Newsletter, presents relevant information semi-annually. Based on this, it appears that short-term projections for Arizona are highly accurate.

7. Consider Earnings When Planning Programs

Lecht (1976) suggested that vocational education program planners should consider not only the number of jobs available in occupational areas but also the earnings that were to be expected. This suggestion was based on the results of his study that examined earnings for 120 occupations. The results of the study indicated that vocational programs prepared people for occupations which cover the earnings gamut, but there was a concentration at the lower end, at less than the median of the earnings scale for all occupations. For example, in 1970 the median earnings of a full-year worker in the U.S. was just under $10,000. However, 41 percent of those employed in occupations included in the study (including those in which vocational education concentrates its training) had median earnings under $8,000, or $2,000 a year less than the median figure for all year-round workers. Therefore Lecht (1976) felt that when making program decisions, it was important to consider not only employment opportunities but also to consider the earnings to be expected in an occupation.

Regarding the previously mentioned study, it should be remembered that Lecht (1976) was comparing median average incomes of all workers, while the vocational educator is concerned primarily with entry-level positions.

8. Improve Communication Between Producers and Users of Employment Projection Information

Stevens (1976) indicated that the most significant problem in the past has been that while a large amount of information has been generated about the labor market, few individuals have made the necessary effort to assure user understanding of its strengths and weaknesses, and intended purpose. While the NOICC and SOICCs have done a great deal to improve this situation in the recent past (the Arizona OIS Users' Manual is an excellent example of this improvement), it would seem that the above comment by Stevens still has relevance today.

Chapter 4

INTERVIEWS

Semi-structured interviews were conducted with individuals within the State of Arizona who have an intimate knowledge of employment projection methodology information. These interviews were conducted by phone or in person. The discussion focused on the nature of the projection methodology, strengths and weaknesses of the methodology, and recommendations for improvements. Individuals contacted were from many different areas of expertise. Contacts included personnel from the following areas:

-Arizona Department of Education
-Arizona Department of Economic Security
-The University of Arizona, Department of Economic and Business Research
-Tucson and Phoenix Chambers of Commerce
-County Planners
-Community College Planners
-High School Program Planners

Results

In many ways, the results of the interviews indicated that Arizona's Occupational Information System is well detailed in the Users' Manual. This is an excellent source of information concerning the present projection methodology. It is very frank in the discussion of the present methodology and clearly indicates areas of weakness in the data base. Many of the limitations discussed in the previous literature review and in the OIS Users' Manual were again raised as concerns in the interviews. For example, it was suggested that:

1. The classification (coding) methodology has improved greatly in the recent past. These coding systems change frequently and there is a need to be aware of and keep up to date with these changes (e.g. the Classification of Instructional Programs is a recent innovation).

2. There are weaknesses in using the employment service data (Job Service Information) as a basis for development of allocation ratios for use in the crosswalk methodology. This information does not offer comprehensive coverage of jobs. It deals primarily with lower level positions and therefore may introduce bias into the allocation ratios.

3. It is difficult to get good information at the county level due to confidentiality restrictions. This, of course, presents problems when trying to plan at the county level. Local area projections also

suffer from the same constraints. However, a system was discussed whereby state data is tailored to local needs through discussion of local job issues with community groups. Parenthetically, it should be noted that the input of private business through County Planning Councils has been very helpful in improving the linkage between vocational education and the labor market.

4. The lack of information on replacement needs due to occupational mobility limits demand data.

5. Many issues with supply information remain problematic, for example:

a. How should the systems account for "in-migration" of workers?

b. Many individuals enrolled in community college vocational education programs are employed and are upgrading their skills (estimates range from 50-60 percent of the class). Therefore, how many within a program area are new supply?

c. Private technical and business schools are not required to report information on enrollment by program; therefore, how many trained workers are supplied to the labor market?

d. How should the systems identify the individual's program? Many individuals do not decide on an occupational goal or change programs frequently.

The following general concerns about the data were raised by those individuals interviewed:

1. The OES information can be used

> ...to determine the job categories in which large numbers of people are employed and to project employment opportunities for job categories in which labor market conditions are relatively stable. Job categories can be grouped according to similarity of skills and functions and then related to training programs. It is more difficult to project employment opportunities for new and emerging jobs, especially in the high technology industries. Other sources of information, such as special industry surveys, can be helpful in defining new job skills to be taught. (LeBlanc, 1984)

2. There is need for improvement of methodology to identify new and emerging occupations.

3. Those interviewed indicated they felt they needed to improve their communication with the DES staff. They seemed to feel the labor market information was being made available by DES but that they were confused about how to use it.

4. Finally, on a more positive note, it was indicated that while the present methodology is not perfect, it is very good. The Occupational Information System of Arizona data base is good for use in planning and counseling. The data is there: planners need to be made aware of this important resource and how to use it.

Recommendations From the Interviews

1. Strengthen the use of industry advisory personnel in the planning of vocational programs.

2. Improve supply information by including private technical and business school program data.

3. Use Labor Market Information staff as a resource in the program planning process.

4. It is recommended that inservice training be provided for users of this information in order to make them aware of the many facets of the information that is currently available.

Chapter 5

SUMMARY AND RECOMMENDATIONS

Summary

In this monograph methodologies used for predicting work force needs (or labor market demands) were examined. Methodologies at both the national and state levels were examined.

The data base for making State employment projections has improved considerably since 1979 when Arizona moved from the decennial census to Occupational Employment Statistics (OES) surveys. A matrix has been developed which provides estimates of current employment by industry for the state and for individual counties. The matrix is used in projecting future occupational employment and average annual openings by occupation. Predictions made by the Labor Market Information staff in Arizona have been remarkably accurate.

There has been considerable cooperative effort between the Labor Market Information staff and the Arizona State Occupational Coordinating Committee in the Arizona Department of Education, with plans to continue this effort. Labor Market Information and Arizona State Occupational Coordinating Committee staffs have addressed the problem of the different classification systems used by those who generate the data and those who use the data. A communication system, called "crosswalks," has been developed.

In Arizona, Dr. Phillip R. Zurbrick at the University of Arizona has reported on agricultural occupations at both state and county levels over a period of years. Projections for the occupation of homemaking have not been done. An examination of census data for Arizona indicates that some projections could be done.

However good the data, some skills are needed to use it effectively. The major problem was concerned with users who reported that they did not understand how to use the data for decision making. Labor Market Information indicated an interest in developing a user's handbook should funds for such a project become available. A program planning model, which would not only help users understand the data, but also put it together with other types of information has been suggested.

Recommendations

1. Arizona Department of Education personnel should continue to work closely with the Labor Market Information Staff. A handbook for users of labor market information should be developed in cooperation with LMI staff. Workshops to train key personnel in the use of labor market information should also be developed and conducted.

2. Personnel at the University of Arizona should continue its study of agriculture employment and demand in Arizona. The agriculture data should be reported in a format consistent with the LMI data.

3. Definitions of "turnover" or "turn rate" and "replacements" should be examined. Estimates currently in use do not identify the turnover in employment in entry-level occupations nor the movement of personnel within a business or industry through promotion.

4. Follow-up data should be used to identify entry level job titles for specific vocational programs and to be the crosswalk from vocational programs to occupations.

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Appendix A

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Appendix B

PERSONS INTERVIEWED

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Appendix C

GLOSSARY OF ABBREVIATIONS

ASOICC	Arizona State Occupational Information Coordinating Committee
BLS	Bureau of Labor Statistics
CPS	Current Population Survey
DES	Department of Employment Security
DOT	Dictionary of Occupational Titles
LMI	Labor Market Information
NOICC	National Occupational Information Coordinating Committee
OE	See USOE
OES	Occupational Employment Statistics
OIS of Arizona Users' Manual	Occupational Information System of Arizona Users' Manual
SOC	Standard Occupational Classification
USOE or OE	United States Office of Education